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Relationship Between Soccer-Specific Skills and Skill-Related Fitness in Adolescent Soccer Players

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Abstract

The purpose of this study was to examine the relationship between soccer-specific skills and skill-related fitness in adolescent football players. Thirty male soccer players (age: 15.86 ± 0.69 years; football experience 7.10 ± 1.70 years) were recruited from a soccer team. Soccer players performed both soccer-specific skill tests and skill-related fitness tests. Soccer-specific skill tests included the Loughborough soccer passing test, Yeagley soccer test, Mor–Christian general soccer ability skill test, and the skill-related fitness tests consisted of the alternate-hand wall-toss test, countermovement jump test, sport-specific core muscle strength and stability plank test, pro-agility test, 20-m sprint test, and lower-quarter Y balance test. Pearson product-moment correlation analyses revealed a moderately positive correlation among the Mor–Christian general soccer ability skill test score (dribbling), pro-agility test score ($r = 0.44$, $p = 0.01$), and 20-m sprint time ($r = 0.43$, $p = 0.01$). There were no correlations among other variables for both the soccer-specific skill tests and skill-related fitness tests. Based on the findings of the study, we conclude that dribbling drills in soccer should be supported by agility and sprint exercises to increase dribbling speed by soccer trainers and soccer players.

Key words: Motor fitness, Dribbling, Passing, Ball control, Team-based ball players

INTRODUCTION

In recent years, soccer games have become extremely popular because of their explosive, short intermittent activities that can change game scores suddenly, such as changes in direction, sprinting, jumping, and kicking the ball (28). Another factor that explains why soccer is so popular worldwide is that it is stochastic, acyclical, and intermittent with uniqueness through its variability and unpredictability (4). A player's success in soccer depends on a complex multidimensional performance that is influenced by technical, tactical, physical, anthropometric, and mental factors (15).

Physical fitness may be the most important determinant of sports performance (14). Physical fitness is defined as the capacity to perform daily activities with vitality and sharpness, without undue fatigue, while appreciating the recreation time interests and facing unpredicted emergencies (25). Physical fitness components are classified as health- and skill-related fitness (14). Body composition, cardiorespiratory fitness, muscular strength, muscular endurance, and flexibility comprise health-related fitness, whereas skill-related fitness consists of speed, agility, power, balance, coordination, and reaction times (9,14).

Some researchers have argued that morphological and physical characteristics and tactical and technical skills successfully discriminate soccer players by competitive level, position, and talent identification (3,9). Kokstejn et al. (16) concluded that the lack of a direct relationship between skill-related fitness and specific technical skills, such as speed dribbling, in prepubescent soccer players. Aslan & Ersöz (2) also reported that there is no correlation between skill-related fitness and soccer-specific skills in amateur soccer players 19–30 years of age.

During the last two decades, technical and tactical skills and physical fitness have been frequently explored and identified as key determinants of young players' game performance, serving as discriminants between elite, subelite, and non-elite youth soccer players (11,15,16, 19,24), but contradictory results (2,3,9,15,16) make it difficult for soccer coaches and other sports-related individuals (e.g., talent agents, sports club managers) to apply the results involving the relationship between skill-related fitness and skill-related fitness research. Therefore, the purpose of this study was to examine the relationship between soccer-specific skills and skill-related fitness in adolescent football players. We hypothesized that there is a significant negative or positive relationship between soccer-specific skills and skill-related fitness.

MATERIAL & METHODS

Procedures

Soccer-specific skill tests and skill-related fitness tests were led on two consecutive days by the same researcher at the same time of day (5.30–7.30 PM). Body mass and height were measured on the first test day, as well as results on the alternate-hand wall-toss test, lower-quarter Y balance test, 20-m sprint test, pro-agility test, countermovement jump test, and core muscle strength and stability plank test. On the second day, players performed the Loughborough soccer passing test (LSPT), Yeagley soccer test, and Mor–Christian general soccer ability skill test. Each test session initiated with a warm-up consisting of 5 min of jogging and 5 min of dynamic stretching exercises. Each test was performed twice with 90-s intervals, and statistical analyses were performed to determine the best score. A 3-min rest period was offered to the players between the tests.

Study population

Thirty male soccer players were recruited for the study from the youth system of the xxxx football team, which competes in the Turkish Regional Amateur League. This study was conducted in accordance with the ethical standards of the Declaration of Helsinki and was approved by the xxxxxxxx University Ethics Committee (2020.171.07.04). The players and their parents received a verbal explanation of the experimental design and signed an informed consent form before participating in this study. The inclusion criteria were as follows: a) soccer experience of at least 5 years, b) playing soccer in the youth system, c) participation in soccer training regularly, and d) being free from any musculoskeletal injuries or cardiovascular and neurological disorders. Players who did not participate in team soccer training for more than 3 months for any reason were excluded from the study. Players were informed that they should avoid heavy training or exercise, taking sedatives, and using supplements before the tests. The players were also instructed to continue their normal food consumption, fluid intake, and sleep patterns.

Measurements

Body mass was measured using a digital balance scale with a foot-to-foot bioelectrical impedance system (Tanita, BC 545 N). Height was measured using a calibrated portable stadiometer (Mesilife 13539).

Skill-related fitness tests

Alternate-hand wall-toss test: The alternate-hand wall-toss test is used to measure coordination, in which the subject throws a ball from one hand using an underarm action against the wall at a certain distance from the wall and attempts to catch the ball with the opposite hand. The total number of repetitive actions was recorded for 30 s. In this study, the distances were set to 2.0 and 1.2 m, which formed the basis for division into two groups. First, the ball was thrown with the right hand and caught with the left hand, and the ball was then thrown with the left hand and caught with the right hand; this was recorded as a single action (7)

Lower-quarter Y balance test: The dynamic balance of the players was evaluated using the Y-balance test via Functional Movement Systems (Lynchburg, VA, USA). All participants performed the test without wearing their shoes. They were permitted two practice trials before recording the

true measurements corresponding to their dominant leg. Leg length was measured from the inferior tip of the anterior superior iliac spine to the distal end of the medial malleolus (17). The lower-quarter Y balance test was used to examine the maximum reach of the lower extremity of the dominant leg in the anterior, posteromedial, and posterolateral directions while the participant maintained a unilateral stance with the opposite leg centered on a platform. According to the standardized protocol, a trial was considered invalid if the participant (i) failed to maintain a unilateral stance; (ii) landed on the reaching foot; (iii) failed to return to the starting position, such as by removing the hands from the hips; or (iv) pushed or kicked the indicator to increase distance. Three trials were repeated for each direction, and the examiner recorded the maximum reach score (17). The normalized composite score was calculated by summing the maximum reach in each of the 3 directions, and then dividing this value by 3 times the leg length for that side. The leg length was standardized to the right leg and measured from the inferior tip of the anterior superior iliac spine to the distal end of the medial malleolus (6).

Twenty-meter sprint test: The subjects performed a 20-m sprint, and the time was recorded using a photocell gate (Newtest Powertimer 300-series, Oy, Finland). The test initiated with the subject in a standing position and with the front foot placed 0.2 m from the first photocell gate (10).

Pro-agility test: The test initiated with the subject in a neutral stance. Thereafter, the subject was instructed to sprint to either the dominant or non-dominant side first and to touch a cone that was placed 5 m away from the starting point. Subsequently, they were asked to run to the opposite side, touch the farthest cone at 10 m, and perform a 5-m sprint toward the finish line (10). The time was recorded using photocell gates (Newtest Powertimer 300-series, Oy, Finland).

Countermovement jump test: The countermovement jump height was measured using a Myotest Pro system accelerometer (Myotest SA, Switzerland). After recording the body mass of the players using the device, the device was attached to the belt and fixed vertically. The subjects were instructed to reach the maximum jump height when they perceived the acoustic signal sounds. The participants maintained their hands on their hips before and during the jump, with their legs maintained straight during the flight phase of the jump (8). The players were instructed to be approximately equal to 90 °at the knee joint for each jump condition (22).

Sport-specific core muscle strength and stability plank test

The sport-specific core muscle strength and stability plank test, covering a period of 180 s, was used to observe the core strength and core stability development of the athletes. The time between test initiation and until the athlete became tired and/or disrupted his/her posture was recorded in seconds (23).

Soccer-specific skill tests

All soccer-specific tests were performed with ball number 5. The soccer ball used in professional leagues and the FIFA World Cup is referred to as "size 5" (5). During the soccer-specific skill tests, the timed trials were recorded using a stopwatch (Casio, HS-80TW-1DF)

LSPT

The LSPT is a reliable and valid test used to assess the multifaceted aspects of soccer skills including passing, dribbling, ball control, and decision making (18). In the present study, the LSPT was used to evaluate the players' passing skills, and the test was performed in compliance with the study of McDermott, Burnett & Robertson (20). In the LSPT, a total of 16 passes were completed. These included 8 short passes to red and white targets 3.5 m away from the passing zone and 8 slightly longer passes to green and blue targets 4 m away from the passing zone, and 4 pieces of colored cards (0.3 × 0.6 m) were taped to the centers of standard gymnasium benches as targets. Furthermore, an aluminum strip (0.1 × 0.15 m) was taped vertically to the center of the target to provide audible reinforcement of a successful pass. The order of these passes was randomly generated into four passing orders. The next color to be hit was called out by one of the examiners as soon as the ball had been released for the previous pass. The time taken to complete the test was recorded using a stopwatch. Timing was initiated from the moment the participant moved the ball into the passing zone and completed when the ball on the final pass made contact with the target area. During the test, penalties and successful passes were recorded.

Yeagley soccer test

The Yeagley soccer test is used to evaluate players' ball control skills. The test initiates with a

command, and players attempt to control the ball with the feet, head, knees, shoulders, and chest for 30 s. The number of juggles within 30 s was recorded for the statistical analyses. If the players attempted to use a hand or arm to control the ball, a one-point penalty was imposed (29).

Mor–Christian General Soccer Ability Skill Test

The Mor–Christian general soccer ability skill test is generally used to evaluate players' passing, dribbling, and shooting skills (21). In the present study, the test was used to evaluate the players' dribbling skills. In the test, 12 cones were arranged in a circle with a radius of 18 m with a distance of 4.5 m between each cone. The start line was marked 1 m away from the circle perpendicularly (21). With a start command, the players dribbled the ball between the cones as quickly as possible. The test was performed twice, clockwise and counterclockwise. The best score was used for the statistical analyses.

Statistical analysis

Statistical analyses of the data in the study were performed using SPSS 18.0. In the analysis of the data, descriptive statistics (including the mean, standard deviation, median, min–max value, rate, and frequency) were used to define the characteristics of the research group; these are expressed in tables. To determine whether the study data were normally distributed, the kurtosis and skewness values were examined. These values were between -1.5 and +1.5; the data showed a normal distribution, and the values outside these measures did not show a normal distribution (30). All data showed a normal distribution, and in this study, Pearson product-moment rank correlation coefficient analysis was conducted to determine the relationships between variables. P values <0.05 were considered statistically significant.

RESULTS

The descriptive characteristics of the players are presented in Table 1. Skill-related fitness characteristics and soccer-specific skills of the players are presented in Tables 2–3, respectively. The relationships between skill-related fitness characteristics and soccer-specific skills of the players are presented in Table 4.

Table 1. Descriptive characteristics of the players

Variables	Minimum	Maximum	Mean	SD
Age (year)	14.60	17.50	15.86	0.69
Sport experience (year)	5.00	10.00	7.63	1.44
Soccer experience (year)	4.00	10.00	7.10	1.70
Height (cm)	158.70	196.00	173.06	8.10
Body mass (kg)	43.00	90.00	64.80	9.68
BMI (kg/m^2)	17.20	25.20	21.59	1.99

BMI: body mass index, SD: standard deviation

Table 2. Skill-related fitness characteristics of the players

Variables	Minimum	Maximum	Mean	SD
Coordination (n)	15.00	28.00	21.86	3.08
CMJ height (cm)	32.50	47.90	39.12	4.47
Sport-specific core muscle strength and stability plank test (s)	54.00	180.00	118.13	34.51
Agility (s)	4.52	5.58	5.07	0.23
Speed (s)	2.79	3.35	3.04	0.14
Dominant leg reach (cm)	58.70	105.10	74.85	10.31
Nondominant leg reach (cm)	57.30	100.70	73.69	9.76

CMJ: countermovement jump, n: repetition, SD: standard deviation

Table 3. Soccer-specific skills of the players

Variables	Minimum	Maximum	Mean	SD
Pass accuracy (n)	38.70	84.00	56.64	13.35
Pass score in time (s)	6.00	14.00	10.63	2.18
Ball control (n)	39.00	94.00	68.06	14.77
Dribbling speed (s)	12.78	17.83	15.24	1.26

n: repetition, SD: standard deviation

Table 4. Relationship between skill-related fitness characteristics and soccer-specific skills of the players

Variables		Coordination (n)	CMJ height (cm)	Core muscle strength and stability test (s)	Agility (s)	Speed (s)	Dominant leg reach (cm)	Nondominant leg reach (cm)
Succesfull pass (n)	r	-0.09	-0.19	-0.34	0.23	0.21	-0.18	-0.03
	p	0.62	0.31	0.06	0.21	0.25	0.32	0.87
Pass score (s)	r	-0.00	0.15	-0.01	-0.04	-0.13	0.10	0.02
	p	0.96	0.40	0.93	0.81	0.48	0.56	0.88
Ball control (n)	r	0.08	-0.05	0.18	-0.36	-0.16	0.06	-0.12
	p	0.66	0.76	0.33	0.05	0.37	0.73	0.50
Dribbling speed (s)	r	-0.25	-0.08	-0.31	0.44*	0.43*	-0.14	0.07
	p	0.18	0.66	0.09	0.01	0.01	0.43	0.68

p<0.05*, CMJ: countermovement jump, n: repetition

As shown in Table 4, there were moderate positive relationships among dribbling speed, agility, and speed variables of the players (r = 0.44 and 0.43; p < 0.05, respectively).

DISCUSSION

This study aimed to examine the relationship between soccer-specific skills and skill-related fitness in adolescent football players. The main finding of this study is that agility and speed are moderately positively correlated with dribbling speed. Based on this result, the hypothesis of the study (that there is a significant negative or positive relationship between soccer-specific skills and skill-related fitness) was partially verified.

Passing, dribbling, ball control, kicking, and shooting are basic soccer techniques (15,16,25). These basic soccer-specific skills might be affected by several factors, such as age, maturity, body composition, power, muscle strength, muscle endurance, and balance (3,25,31,32)

Singh et al. (25) reported a strong association among physical, technical, conditional, and tactical components in soccer. Kokstejn & Musalek (16) found a strong relationship between fundamental motor skills (running, broad jumping, leaping, hopping, galloping, and sliding) and game-specific motor skills (dribbling and shooting) in adolescent Czech football players. Vänttinen et al. (31) also reported that passing accuracy is associated with the 10-m sprint (r = 0.71, p < 0.05), countermovement jump performance (r = - 0.62, p < 0.05), and eye–hand–foot coordination (r = 0.63, p < 0.05) in adolescent soccer players.

In a study conducted by Aktuğ, İri & Çelenk (1) of 337 male soccer players aged 6–14 years, soccer-specific skill test results (Deutscher motor test, Mor–Christian general soccer ability test) were positively or negatively correlated to the results of the 20-m sprint test, horizontal obstacle jump test, flexibility test, broad jump test, balance test, 6-min running test, push-up test, and trunk flexion test. Similar to our study, Aktuğ et al. (1) reported a positive correlation between the 20-m sprint performance and dribbling skills.

In another study that aimed to understand the kind of sprint (20-m linear sprint vs. change-of-direction sprint and Illinoist agility test) associated with the Mor–Christian dribbling performance test (12), the change-of-direction sprint test and Illionis agility test performances were positively and moderately correlated with the Mor–Christian dribbling test score; however, the positive correlation between the 20-m linear sprint time and Mor–Christian dribbling test score was insignificant and small.

In our study, the correlation between the non-linear sprint (agility), linear sprint (20-m sprint), and dribbling performance differed, although in the study by İslam & Kundu (12), non-linear test scores (change-of-direction sprint and Illinoist agility test)

positively and moderately correlated with the Mor–Christian dribbling performance test performance; however, the 20-m linear sprint time exhibited a statistically non-significant positive small correlation with the Mor–Christian dribbling performance test. Meanwhile, in our study, both the pro-agility test time and 20-m linear sprint time were moderately positively correlated with the dribbling speed.

Some researchers have reported correlations between skill-related fitness and soccer-specific skills as in the aforementioned studies, but Kokstejn et al. (15) argued that the direct correlation between physical fitness (shuttle run 4 m × 10 m, standing broad jump and 20-m progressive shuttle run) and speed dribbling (short dribbling test) is not significant. Singh & Singh (26) also reported an insignificant relationship between soccer-specific skills assessed based on the SAI soccer skill test, agility, and explosive strength in junior soccer players. Kadagadakai & Pradhan (13) reported no correlation between the grip strength; flexibility; sit-ups; Harvard step test performance; and soccer skill tests, such as dribbling, lofted-passing, shooting, short-passing, and juggling, in 41 diploma college soccer players. Kadagadakai & Pradhan (13) found only a significant negative moderate correlation between the body mass index and dribbling, with the BMI being significantly (borderline) positively correlated with juggling.

As it is understood, there are studies that have demonstrated that there are no relationships between skill-related fitness and soccer-specific skills, even though these comprise fewer studies than studies that have demonstrated positive or negative relationships between skill-related fitness and soccer-specific skills at a meaningful level. These contradictory results might be caused by age, status (professional or amateur), playing positions, biological maturation, and anthropometric characteristics of soccer players (9,15,16,31).

This study had two limitations. First, we performed all soccer-specific tests using ball number 5. This ball size may not have been suitable for the players recruited for this study. Second, because all soccer players were recruited from a single soccer club, the sample size of the study was relatively small.

CONCLUSIONS

In conclusion, based on the findings and considering some limitations, the present study showed that dribbling drills in soccer should be supported by agility and sprint exercises to increase dribbling speed by soccer trainers and soccer players. Talent identification and discrimination of soccer players by competitive level and position are important for nations to represent their countries optimally in international sports competitions. Therefore, further studies are needed to clarify whether skill-related fitness affects skill-related soccer-specific skills. In addition, conducting similar studies with larger sample sizes may lead to different results in the field of exercise science.

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